MISSOURI DEPARTMENT OF NATURAL RESOURCES
AIR AND LAND PROTECTION DIVISION
ENVIRONMENTAL SERVICES PROGRAM
Standard Operating Procedures

SOP #: MDNR-FSS-250 EFFECTIVE DATE: January 24, 2002

SOP TITLE: Thermoluminescent Dosimetry Badge Management Program

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SUMMARY OF REVISIONS: Not applicable. This is a new SOP.

APPLICABILITY: The procedures described in this SOP applies to all Department of Natural Resources field personnel required to wear TLD badges and to the maintenance of associated dosimetry records.

DISTRIBUTION:
MoDNR Intranet
ESP FSS Section Chief
ESP SOP Coordinator
ESP EER Section Chief

RECERTIFICATION RECORD:

Date Reviewed				
Initials				

1.0 SCOPE AND APPLICABILITY

Two programs within the department have staff who have been issued thermoluminescent dosimetry (TLD) badges for the purpose of measuring occupational exposure to ionizing radiation. Those staff that have been issued TLD badges include: Environmental Services Program (ESP) field staff who conduct environmental emergency response activities and Hazardous Waste Program (HWP) staff within the Federal Facilities Section who conduct field work at Department of Energy (DOE) sites. This Standard Operating Procedure (SOP) provides guidance to those staff on the use of TLD badges and the management of dosimetry records.

2.0 DEFINITIONS AND ACRONYMS

2.1 Acronyms

ALPD	Air and Land Protection Division
DM	Dosimeter Manager
ESP	Environmental Services Program
HWP	Hazardous Waste Program
rem	Roentgen Equivalent Man
RSHPP	Radiation Safety and Health Protection Program
SOP	Standard Operating Procedure
TLD	Thermoluminescent Dosimeter

2.2 Definitions

Action Levels
: The quarterly dose for occupational exposure which triggers a review of employee activities to determine the source of exposure.

Annual Limit
: The total allowable annual internal and external dose from occupational exposure for a individual employee.

Background Radiation
: Radiation arising from naturally-occuring radioactive material (i.e., cosmic rays, natural radioactivity, radioactive substances in building material).

Control TLD Badge
: An instrument used to measure radiation exposure from natural sources. These sources include cosmic radiation and radiation from naturally-occurring radioactive materials, e.g., radium, thorium, uranium.

Dose
: A general term denoting the quantity of radiation or energy absorbed by the body.

Dosimetry Vendor
The supplier under contract who provides TLD badges and analytical services.

External Exposure
The dose of radiation received by an individual from a source of ionizing radiation outside the body.

Internal Exposure
The dose of radiation received by the internal organs of the body from radionuclides ingested, inhaled or absorbed into the body.

Ionizing Radiation
Any electromagnetic or particulate radiation capable of displacing electrons from atoms or molecules.

Mrem
One one-thousandth of a rem

Occupational Exposure
The total dose of radiation received by an employee while conducting fieldwork.

Radiation Safety and Health Protection Program (RSHPP)
A comprehensive program designed to monitor employee exposure to radiation.

Radiation
Energy emitted in the form of waves and particles. Includes alpha particles, beta particles, gamma rays, x-rays, and neutrons.

Control Dosimeter
An instrument used to measure radiation exposure from natural sources. These sources include cosmic radiation and radiation from naturally-occurring radioactive materials (e.g., radium, thorium, uranium).

Roentgen Equivalent Man (rem)
A unit used to relate the absorbed dose of radiation to the effective biological damage of the radiation.

Thermoluminescent Dosimeter (TLD) Badge
A device made of crystalline material that is capable of storing energy (a fraction of absorbed ionizing radiation). When the material is heated in a TLD badge reader, light is emitted and the absorbed dose can be quantified to determine exposure.

3.0 RESPONSIBILITIES

3.1 Field Staff

It is the responsibility of each person assigned a TLD badge to be read, understand, and comply with this SOP.

3.1.1 All department staff who have been issued a TLD badge shall participate in the ALPD's medical monitoring program.

3.1.2 A control TLD badge will be provided with each group of badges sent by the TLD vendor.

3.1.3 All department staff who have been issued a TLD badge must wear their TLD badge for all field and environmental emergency response work.

3.1.4 The TLD badge shall be worn on the front of the body above the waist and below the neck. The badge shall be worn with the name of the participant facing outward.

3.1.5 All department staff responsible for a TLD badge shall appropriately store the badge to prevent damage and inadvertent exposure to above-background levels of exposure. To appropriately store the TLD badge, field staff should attach the badge to their in/out basket when not in use. In addition, the control TLD badge associated with that quarterly group of TLD badges should not leave the office of the person to whom the control badge has been assigned until the quarter is over and all the badges are shipped back to the vendor for analysis.

3.1.6 The personal TLD badge and the control TLD badge should never be worn when undergoing any sort of medical x-ray procedure or passing through x-ray security checkpoints, such as those found at airports.

3.1.7 If any department staff believe that they have received an internal exposure to radiation then they must immediately report the possible internal exposure to their supervisor, their Program Director, and the ALPD Health and Safety Officer. Internal radiation monitoring may be required at the discretion of the ALPD Health and Safety Officer.

3.2 Supervisors

It is the responsibility of each supervisor who has an employee that has been assigned a TLD badge to read, understand, and comply with this SOP. In addition, each supervisor must ensure that their employees who have been issued a TLD badge are thoroughly familiar and comply with this SOP.

3.3 Dosimeter Manager (DM) or Designee

It is the responsibility of the DM to implement the administrative functions associated with this SOP. These administrative functions can include, correspondence with the TLD vendor and employees that are issued a TLD badge, management of the distribution of the badges, filing quarterly badge reading documents, and coordination with the ALPD Health and Safety Officer regarding TLD badges and other duties as assigned

3.4 ALPD Health and Safety Officer

It is the responsibility of the ALPD Health and Safety Officer to review all TLD badge reports, track staff exposures, advise staff of quarterly TLD readings, and investigate excessive exposures. In addition, it is the responsibility of the Health and Safety Officer to consult with supervisors and personnel regarding TLD badges as needed.

3.5 ESP Director or Designee

It is the responsibility of the Program Director or Designee to maintain all personnel radiation exposure records and to give approval for the purchase and analysis of the TLD badges.

4.0 EQUIPMENT

- TLD badges

5.0 PROCEDURE

5.1 Procedures for TLD badges

5.1.1 TLD badges will be exchanged and returned to the dosimetry vendor on a quarterly basis. The ALPD Health and Safety Officer will review the TLD badge analytical results. The exchange cycle may be more frequent, depending upon various conditions including pregnancy and suspected worker exposures, as determined by the ALPD Health and Safety Officer. Upon declaration of pregnancy, radiation exposure monitoring of the ESP employee shall be increased to a monthly cycle during the gestation period.

5.1.2 A TLD badge no longer needed by an employee (termination, transfer, etc.) shall be returned to the DM, placed with the radiation control dosimeter and processed with the next quarterly shipment.

5.1.3 The following information will be maintained on the TLD Badge Individual Summary Sheet (Attachment 1) for each radiation dosimeter issued: name,

date it was issued, date it was exchanged, date it was mailed back to the dosimetry vender, and the initials of the DM.

5.1.4 It is strongly recommended that each employee who conducts field activities maintain a radiation dosimeter use log. The personnel shall record the date and location of each occasion on which the radiation dosimeter is worn. This will aid the DM in any follow-up investigations where an employee may have received a potential significant radiation exposure.

5.2 Procedures for lost TLD badges

5.2.1 Department staff will be required to immediately report the loss of a TLD badge to their supervisor who shall in turn report the loss to the DM. The person who lost the TLD badge must make a reasonable attempt to find the lost badge by checking work areas and equipment. If the badge cannot be located, the employee shall immediately complete the Lost TLD Badge Report (Attachment 2).

5.2.2 If a TLD badge is lost and a replacement TLD is issued, the date issued, exchanged, and returned as well as the initials of the DM shall be recorded on the TLD Badge Individual Summary Sheet (Attachment 1).

5.2.3 If a TLD was lost and later found, this information shall be recorded on both the Lost TLD Badge Report (Attachment 2) and the TLD Badge Individual Summary Sheet (Attachment 1) (assuming a replacement has been issued). The lost radiation dosimeter may be returned to the dosimetry vendor and analyzed at the discretion of the ALPD Health and Safety Officer.

5.3 Procedures for TLD Shipment

5.3.1 TLD badges shall be exchanged and processed at least once every quarter or more frequently at the discretion of the ALPD Health and Safety Officer.

5.3.2 The used TLD badge shall be shipped with the appropriate TLD control badge. Any specific instructions, and documentation required by the TLD vendor shall be the responsibility of the DM.

5.4 Procedures for TLD Dose Control and Action Levels

5.4.1 The **annual limit** for a total internal dose and external dose from occupational exposure is 0.5 rem (500 mrem) per year for a department employee. The year shall be defined as the amount of exposure within 365 consecutive days. The 0.5 rem value represents the maximum allowed dose for an individual department employee * covered under this SOP. Once a worker has reached this level, no further work activities where the potential

for significant radiation exposure exists will be permitted without first obtaining the written approval of the ALPD Health and Safety Officer.

* The annual limit for a pregnant woman is 0.5 rem (500 mrem) for the entire pregnancy.

5.4.2 The **action level** for a total internal dose and external dose is 0.05 rem (50 mrem) per quarter for a department employee. Any exposure which exceeds this action level will trigger a review of the circumstances relating to the exposure by the ALPD Health and Safety Officer. This review may result in modification of practices, retraining, or the implementation of other control measures.

6.0 RECORDS

Vendor-generated radiation exposure reports are to be reviewed by the ALPD Health and Safety Officer. The ALPD Health and Safety Officer will write a memo providing the individual quarterly results to each employee that has been assigned a TLD badge. A copy of the memo shall be sent to the employee's supervisor and or Program Director. The Director will include this information in the employee's medical monitoring file.

Attachment 1

Thermoluminescent Dosimetry (TLD) Badge Individual Summary Sheet

Name:_____ TLD Badge #:_____

Address:_____ Social Security #:_____

Date Issued (MM/DD/YR)[1]	Date Exchanged (MM/DD/YR)[2]	Date Returned (MM/DD/YR)[3]	Initials[4]

Comments:_____

[1] Date TLD badge was first issued to ESP employee
[2] Date DM or Designee(s) exchanged TLD badge with ESP employee
[3] Date TLD badge was mailed to the vendor
[4] Initials of DM or Designee(s)

Attachment 2

Lost TLD Badge Report

1. Name:_____ Date:_____

   Address: _____

   _____

   Date Issued:_____ Date Lost:_____

   TLD Badge ID:_____ Social Security #:_____

2. Names of co-workers (from the date of issue to the date lost) whose dose would most closely approximate that of the person who lost the TLD badge:

Name of Co-worker	TLD Badge ID	Dose Equivalent (From Radiation Exposure Report From Dosimetry Provider)

3. Dose Equivalent assigned:_____mrem

4. Name of Evaluator:_____ Date:_____

   Signature:_____

5. Comments: